DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
Transportation Laboratory
5900 Folsom Boulevard
Sacramento, California 95819-4612

METHOD OF TEST FOR THE LUMINOUS INTENSITY OF TRAFFIC SIGNAL SECTIONS

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read **"SAFETY AND HEALTH"** in Section H of this method. It is the responsibility of whoever uses this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed. Users of this method do so at their own risk.

A. SCOPE

This method describes the test procedure to obtain the distribution pattern and the measurement of luminous intensities of traffic signal sections in accordance with the distribution pattern set forth in the FHWA Report RD-77-93 "Recommendations, Tables 25 and 26".

B. APPARATUS

1. Spectra Scan Photometer, Model PR650.
2. ND2 Filter, x100 Neutral Density Filter.
3. Laptop Personal Computer (Pentium) with Microsoft Windows, Crosstalk and Excel Software.
4. RS232 Cable (23 meters in length).
5. Goniometer.
6. Electronic Measurements, DC Power Supply (Model SCR 150-10-DV)
7. Fluke Digital Multimeter (Model 8060A).
8. Fluke 10 AMP. 100mV shunt (Model 80J-10)
9. 665 Lumen standard lamp (NBS traceable).
10. 1950 Lumen standard lamp (NBS traceable).
11. 642 Candela standard lamp (NBS traceable).
12. Photometric tunnel (approximately 33.5 m in length).

C. TEST PROCEDURE

1. Setup for the traffic signal intensity distribution pattern measurement.

   a. Alignment of Goniometer.

      (1) Place the telescope on the goniometer table using the fixed locating pin to mate with the telescope base and clamp it into position. (Note: A laser may be used in place of the telescope for alignment.)

      (2) Level the goniometer table by adjusting the control knob (marked "HORIZONTAL" on the control console) and by observing the carpenter level on the table.

      (3) Raise or lower table so the height of centerline of the telescope lens from the floor is 1.51 m (see Figure 1). The motor

switches for the height adjustment are on the side of the goniometer.

(4) Sight through the telescope to the photometer port hole (34.925 mm-diameter) located 30.5 m at the opposite end of the light tunnel. Make sure the photometer is in the "PHOTOHEAD POSITION" 0^0, as indicated on the control console.

(5) When the telescope is aligned with the photometer port hole, the control knobs for the goniometer (marked HORIZONTAL and VERTICAL) should be adjusted to the $0–0^0$ H.V. position.

b. Mounting of a signal section on the Goniometer table.

(1) Remove the hood from the section.

(2) Insert application working standard lamp: 665-Lumen lamp for the 200mm section; 1950 Lumen lamp for the 300mm Section.

(3) After the lamp is inserted into its socket, rotate both socket and lamp together until the open end of the lamp filament is in the upward or "U" configuration.

(4) With straight edge, square, and marking tool, locate the depth of the filament and make a "mark" on the top of the signal section.

(5) Install the signal section on the Goniometer table using scale and square to align the "mark" on the signal section with the centerline crossmark on the table.

(6) Locate center of signal section lens using square, raising or lowering table to exact height, and matching crossmarks on the goniometer table for centerline alignment.

(7) Anchor signal section to the table (using care not to misalign) with a larger "C" clamp and a block of wood which will rest on the top of the signal section. When clamping, some method of restricting a sliding motion of the signal section should be used. A built up tape barrier could be used on the table at the rear of the signal section.

(8) Connect the DC power supply and ammeter to traffic signal section.

c. Measurement of luminous intensity (Candelas)

(1) Position the Spectra Scan PR-650 photometer, with ND2 filter, at a distance of 15.24 m on the line of sight previously established and at the same height as the signal section light center (Figure 1).

(2) Connect RS232 Cable between PR-650 and a laptop computer

(3) Adjust the lamp current to standard current value to obtain appropriate lumen output of the lamp.

(3) Rotate the Goniometer (per Figure 4) and record foot-candle readings for the 44 test points at the 44 angles. Candela values are obtained by multiplying the Candela/m_ values by the square of the distance (see paragraph E). Results are compared to the specified values

in FHWA Report RD-77-93. Repeat for all signal sections.

D. CALIBRATION

1. Place candela standard lamp[1] on Goniometer and orient the lamp so that the plane containing the two filament supports is perpendicular to the axis of the PR650 photometer. The small circle on the lamp is positioned away from the photometer. The distance between standard lamp and photometer is 15.24 mm (height 1.51 m) (see Figure 3).

2. Attach DC power supply and ammeter as shown in Figure 2.

3. The lamp current is increased to the specified value[2], thereby providing specified candelas.

4. Three NBS filters[3] are placed (one at a time) in front of the PR650 photometer lens and the readings (M_s) with each filter are recorded.

5. Calculate correction factor (K) per Section E.

E. CALCULATION

T = Transmittance factor-NBS Filters

M_s = PR-650 reading of candela/m^2 lamp standard through red, yellow and green NBS filters.

K = Correction factor

Cd = Candelas

$$K = \frac{CdxT}{Ms}$$

Typical standard: GE Airway Beacon (Type: 500W, 120VAC) NBS Traceable.

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1. Given in the Electrical Testing Laboratory (ETL) standard lamp certificate.
3. NBS FILTERS — T-Factor
   Red 4-1-9 — 0.197
   Yellow 7-1-3 — 0.653
   Green 1-1-3 — 0.269

F. REPORTING RESULTS

Report the results of the 44 test points in the form shown in Figure 4.

G. DEFINITIONS:

The following definitions shall apply to all California Test Methods that relate to Traffic Signal Heads.

A SIGNAL SECTION is a single light unit consisting of a housing, reflector, lamp receptacle, lamp, lens, door and visor.

A SIGNAL FACE is an arrangement of signal sections, which controls one or more traffic movements in a single direction.

A SIGNAL HEAD is an assembly of one or more signal faces.

A STANDARD SIGNAL FACE is composed of all 200 mm or 300 mm sections.

A COMBINATION SIGNAL FACE is composed of 200mm or 300mm sections.

A SIGNAL LENS is that part of the optical unit which redirects the light coming directly from the light source and its reflector.

H. SAFETY AND HEALTH

Prior to handling, testing or disposing of any materials, testers are required to read Caltrans Laboratory Safety Manual – Part A, Section 5.0, Hazards and Employee Exposure- Part B, Section 5.0, Safe Laboratory Practices, Section 6.0 – Chemical Procurement Distribution and Storage, Section 10.0 – Personal Protective Apparel and Equipment and Section 1.0 – Part C – Safe Laboratory Practices.

REFERENCES:

FHWA Report RD 77-93

End of Test (California Test 604 contains 7 pages)